

**WHAT IS CLAIMED IS:**

1. A method of monitoring a fluid storage and dispensing system, the system comprising measurement apparatus for measuring a volume of fluid associated with the system and a plurality of temperature sensing devices disposed at a plurality of locations within the system, the method comprising:

collecting a plurality of measurement data from the measurement apparatus and the plurality of temperature sensing devices in a form readable by a computer;

storing the plurality of measurement data in a compressed matrix format in a computer memory; and

statistically analyzing the compressed matrix format to determine operational monitoring information and to calculate the volume of fluid based on the measurement data collected from the measurement apparatus and the plurality of temperature sensing devices.

2. The method of claim 1 wherein the statistically analyzing step includes determining a correction value for the calculated volume based on a weighted average of the temperature of the fluid simultaneously measured at the plurality of locations within the system.

3. The method of claim 1 further comprising  
determining the presence of operational defects in the system based on the operational monitoring information.

4. The method of claim 1 further comprising  
monitoring the accuracy of the measurement apparatus and the plurality of temperature sensing devices based on the operational monitoring information.

5. The method of claim 1 further comprising

determining whether a quantity of fluid removed from the system is caused by a leak in the system based on the operational monitoring information.

6. The method of claim 5 further comprising  
delivering a warning if a leak is determined to exist in the system.
7. The method of claim 1 wherein the collecting step is performed continuously at periodic intervals.
8. The method of claim 1 further comprising  
querying the measurement apparatus and the plurality of temperature sensing devices under the control of the computer.
9. The method of claim 1 wherein the storing step comprises generating the compressed matrix format as a product of a data matrix and the transpose of the data matrix.
10. The method of claim 9 wherein the product is formed by addition of partial products of each of a plurality of partitions of the data matrix with the transpose of each partition.
11. The method of claim 1 further comprising  
transmitting the measurement data to a host processor to perform the statistically analyzing step.
12. The method of claim 11 wherein transmitting the measurement data includes wireless transmission.
13. The method of claim 1 further comprising  
transmitting the compressed matrix format to a host computer to perform the statistically analyzing step.

14. A method of monitoring a fluid storage and dispensing system, the system comprising a plurality of measurement apparatus for measuring a volume of fluid associated with the system, the method comprising:

simultaneously collecting measurement data from the plurality of measurement apparatus in a form readable by a computer to determine a change in the volume;

repeating the collecting step to obtain a plurality of the measurement data;

storing the plurality of measurement data in a compressed matrix format in a computer memory; and

statistically analyzing the compressed matrix format to determine operational monitoring information.

15. The method of claim 14 further comprising

estimating an initial value of the volume during the statistically analyzing step based on the operational monitoring information.

16. A method of monitoring a fluid storage and dispensing system, the system comprising measurement apparatus for measuring a volume of fluid associated with the system and a plurality of temperature sensing devices located at different heights in the system, the volume having a height in the system, the method comprising:

collecting a plurality of volume measurement data from the measurement apparatus in a form readable by a computer;

adjusting the volume measurement data based on temperature measurements taken from those of the plurality of temperature sensing devices at a height below the height of the volume in the system;

storing the plurality of volume measurement data in a compressed matrix format in a computer memory; and

statistically analyzing the compressed matrix format to determine operational monitoring information.